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ABSTRACT

It is argued that research on the nature of classroom interaction and on the relationships between such interaction and student outcome measures must use the student rather than the class mean as the basic unit of analysis. This is due to a number of factors: (a) students in the same classroom, no matter how homogeneous, show great individual differences in their personal characteristics and in the kinds of interactions that they have with the teacher; (b) most teacher behavior directed at students is directed at individuals rather than at the whole class, and student individual differences affect such teacher behavior; (c) even teacher behavior directed at the whole class interacts with student individual differences to determine outcomes. Examples of each of these general effects are discussed. (Author/HJB)

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The Student as the Unit of Analysis

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The Student as the Unit of Analysis

As far back as 1971, Tom Good and myself argued that for most purposes the student rather than the class as an undifferentiated group should be the unit of analysis in classroom research (Good and Brophy, 1971). This idea had been built into our Dyadic Interaction Observational Coding System (Brophy and Good, 1970), which at the time was the only system for coding teacher-student interaction which used the individual student as the unit of analysis.

Our immediate concern at the time was the study of the processes through which teachers communicated differential expectations to different students. This research by its very nature required a focus on the individual student, since we intended to compare different students for the kinds of treatments they received from the same teachers. However, upon reflection, it occurred to us that the student should have been the unit of analysis for most preceding classroom research, because most of the variables previously studied, including many of those often assumed to be stable and general characteristics, actually are teacher characteristics that vary with situation and context, and in particular with differences in student characteristics.

The most obvious cases concern those teacher behaviors which are inherently dyadic. That is, they are directed at a single individual student rather than at a subgroup or at the class as a whole. Included here would be many teacher questions, all teacher feedback to student questions or seatwork, most praise and criticism, and most attempts to deal with misbehavior. Such teacher behaviors are in fact, and not merely

by virtue of definition, dyadic interactions directed at an individual student, and they should not be construed as teacher behavior directed at the class as a whole. By extension, neither should average scores for teachers on such variables be taken as necessarily reflective of any stable or consistent trait in teacher behavior. This point will be expanded below.

A more subtle variation of the above occurs in connection with teacher behavior that is initially directed at the class as a whole, such as questions or solicitations for volunteers, but which depend upon student initiative for completion. Here again, although the teacher behavior begins as behavior directed towards the entire class, the interaction evolves into a dyadic one between the teacher and an individual student who obliged the teacher by raising his hand or otherwise indicating willingness to respond. Thus, even teacher behaviors directed towards the class as an undifferentiated whole can ultimately end up involving only an individual student, at least directly.

Thus, upon reflection, it can be seen that relatively few teacher behaviors are solely directed towards the class as a whole or towards a subgroup. Other than lecturing, demonstrations for the whole class, announcements, giving assignments, and the like, most teacher behavior, and, in particular, most teacher behavior that has been considered especially important for teacher effectiveness, is directed at individual students.

Teacher Consistency

Until fairly recently, most classroom research has not taken this factor into account by using the individual student as the unit of analysis.

Instead, mean or average scores have been computed for teachers, and have been construed (at least implicitly) as representative of the teachers' general characteristics presumably applying with equal frequency and intensity to all of the individual students in the class. However, research which has focused on intra-class differences in ways that individual students interact with the teacher has revealed striking differences related to student sex, social class, race, intelligence, and a host of personality variables (Brophy and Good, 1974). In fact, virtually every investigator who has checked data for evidence of significant individual differences within a classroom in patterns of teacher-student interaction has found such differences.

The implication of all of this is that teachers are not nearly as consistent as previous research has assumed them to be (usually implicitly rather than explicitly), so that mean scores computed by dividing the frequency with which a particular teacher behavior was observed by the amount of time that the teacher was observed do not necessarily reflect the teacher's treatment of an individual student in that class. In fact, such scores may not reflect an individual teacher's treatment of <u>anyone</u> in that class.

For example, consider a teacher who was observed to praise students 200 times during 50 hours. If students averaged four times each, and each student was praised no less than three nor more than five times, the praise data for this particular teacher would be accurate and valid. That is, the statement that the teacher averaged about four praise statements per student per 50 hours of observation would hold up, both as a generalization about

behavior in the class as a whole and about behavior towards specific students.

However, most investigations of praise (and, as it turns out, most investigations of other variables, too), find distributions like these to be the exception rather than the rule. With praise, for example, it is typical to find that a very high percentage of the teacher's praise statements go to a very small percentage of the students, those who are very high achievers plus a few that the teacher likes and is working hard with. The remaining students get little or no praise at all. In such classrooms, the mean teacher praise is not representative of the teacher's actual behavior towards any of the students in the class. It under-represents the frequency of praise towards the small subgroup of students who get most of the praise, and it over-represents the frequency of praise directed at the majority of students who seldom get praised at all. The same difficulty holds for mean scores for such behaviors as indirect teaching, criticism, asking probing questions in an attempt to improve student response, asking high level divergent or abstract questions, and many others.

Research Implications

The above considerations, particularly when viewed in combination with theory and data from a variety of sources suggesting that the individual characteristics of students interact with differences in teacher behaviors in determining what is optimal for a particular student, strongly imply that the individual student should be the unit of analysis in classroom process

research. This will be necessary both to gain a better understanding of classroom process and to link classroom process more firmly and clearly to product outcomes. To illustrate briefly, I will give examples from research which I have been involved in the past and/or am involved in at present.

Individual Differences in Teacher-Student Interaction

As mentioned above, Tom Good and myself began originally with the intention of studying teacher-student interaction in order to determine the mechanisms through which differential teacher expectations were communicated to different students. Over time, this line of research broadened from teacher expectations for student achievement to other teacher expectations and attitudes and to the more general series of questions listed below:

1. What student individual differences do teachers notice and use in forming differential expectations and attitudes?
2. Once such differential expectations or attitudes are formed by teachers, what are the implications for teacher-student interaction likely to be?
3. Assuming that teachers do treat students differently because they hold different expectations or attitudes towards them, what effect does such differential treatment have upon the students?
4. What individual teacher differences are involved in determining the nature of teacher reactions to student individual differences and the degree to which these reactions shape future interaction

with students?

These and related topics have been studied in detail by ourselves and other investigators, particularly recently. Many studies are reviewed in our recent volume, Teacher-Student Relationships: Causes and Consequences (Brophy and Good, 1974).

Briefly, studies which have used the individual student as the unit of analysis and concentrated on differential teacher behavior have revealed the following:

Differences in teacher expectations lead some teachers (a minority, however) to teach students optimally if they hold high expectations for the students and to teach other students minimally if they hold low expectations for the students. This is the basic mechanism underlying teacher expectation or Pygmalion effects.

Boys are more salient in the classroom than girls. They have more of every kind of interaction with the teacher, including such presumably desirable interactions as praise from the teacher or opportunities to respond to a question as well as presumably negative ones such as criticism for poor work or misbehavior.

Furthermore, the commonly reported finding that boys get much more criticism for poor work and misbehavior than girls continues to hold up, but studies which have concentrated on individual students have shown repeatedly that the vast majority of such criticism is directed at a small number of boys who show high rates of misbehavior, alienation from the classroom, and (usually) low achievement.

Studies which have taken teacher sex into account show that male teachers have the same kinds of differences in interactions with male versus female students as female teachers do. Thus, the student sex differences observed in classroom process studies are due primarily to the students themselves, and not to the fact that most elementary teachers are female.

Students that the teacher especially likes usually do not receive overt favoritism, although they sometimes receive somewhat more covert favoritism. However, students that the teacher dislikes or rejects usually receive overt rejection.

Among students who do not stand out in the classroom because they are unspectacular in either achievement or general classroom behavior, there usually are two subgroups towards which the teacher behaves quite differently. One group (typically called the "concern" group) become objects of special teacher concern. The teacher tries to spend more time with these students and to give them extra help, recognizing (or at least believing) that they are capable of achieving at higher levels if given some remedial help and some encouragement. The other group (typically called the "indifference" group) are largely ignored by the teacher. They have fewer interactions with the teacher than other students do, and the interactions that they do have tend to be briefer and less personal or affectively toned.

These differences in teacher behavior are apparently in reaction to differences in student characteristics. Although the students are similar in being low to modest achievers and medium to high in conformity to classroom

rules, they differ in other ways that make a difference in teacher response. Children who become objects of special teacher concern show such characteristics as a general teacher orientation, dependency upon the teacher, and apparent desire for interactions with the teacher and gratitude for the help that the teacher provides. In short, they cue the teacher that they desire such treatment and reinforce the teacher for providing it by expressing dependency and gratitude. In contrast, students who end up being treated indifferently by the teacher are very different. These students are not at all teacher oriented and show little or no desire for interactions with or help from the teacher, and they apparently do not reward the teacher (and probably even extinguish the teacher in subtle ways) for interacting with them. In contrast to the concern students, who condition the teacher to develop concern and interact with them frequently, the indifference students condition the teacher to stay away from them and interact infrequently. Furthermore, the data suggesting that interactions with indifference students are briefer and less affectively toned even when they do occur suggest that the teacher indifference involved is an active type, actually a mild form of rejection, and not merely an oversight on the part of the teacher.

These are but a few examples of findings of research on classroom process which has used the individual student as the unit of analysis. For a comprehensive review of this line of research, see Brophy and Good (1974).

Process-Product Studies

Process-product research designed to link observed teacher behavior with measured student outcomes (cognitive or affective), has had a long and frus-

trating history of negative and conflicting results. Improvements in research designs, classroom observation systems, and statistical analysis methods have led to observable improvement in the state of the art in recent years (Dunkin and Biddle, 1974; Rosenshine and Furst, 1973), although even the findings that have begun to be replicated consistently still are relatively weak ones. That is, although correlations between teacher process behaviors and measures of student outcomes are strong enough to reach statistical significance, they are not strong in the absolute sense.

In part, such findings probably reflect reality. Teaching seems to be, and therefore should be construed as, an applied science requiring the teacher to orchestrate a large number of principles and practices, adapting to the specific needs of the immediate situation. In contrast, teaching is not, and therefore should not be construed to be, a matter of mastering a small number of "key" behaviors or characteristics and then applying them consistently. Consequently, it probably is unrealistic to expect extremely strong relationships between teacher process behaviors and student product outcomes (Brophy and Evertson, Note 1).

Nevertheless, it seems obvious that process-product studies would be improved considerably if the student were used as the unit of analysis. First, as discussed previously, many teacher behaviors are directed at individual students anyway, and there are important individual differences in the kinds of interactions that students have with the same teacher. Also, we know that student individual characteristics (which include, but are not limited to, differences in student aptitude) interact with teacher behavior

differences, so that some kinds of teacher behaviors are optimal for certain types of students but different kinds of teacher behaviors are optimal for different types of students (Cronbach, 1975). Some of the differential teacher behaviors which have been observed in classroom process studies have been discussed above, and it is likely that these will have differential effects on student outcomes. In addition, other research has established that students differing in aptitude or personal characteristics showed differential outcomes depending upon the kinds of teaching that they received.

For example, the Texas Teacher Effectiveness Project (Brophy and Evertson, Note 1) showed that student socio-economic status (SES) was an important modifying variable in determining the relationships between teacher behaivor and learning gains in second and third grade students. SES is construed here as a "proxy variable" which stands for a complex of achievement potential, actual achievement, and achievement motivation, so that the SES differences in process-product relationships fit the definition of aptitude-treatment interactions given by Cronbach (1975).

Briefly, this study revealed that high SES students learned more (as measured by standardized achievement tests) when taught more material at a relatively faster pace and in a relatively more demanding and challenging manner. In contrast, low SES children learned more when they were taught less actual material but had this material taught to them more thoroughly by teachers working at a slower pace, modifying the curricula and materials to meet individual needs, and showing such motivational characteristics as patience and encouragement rather than challenge and demandingness.

Also, low SES children did not respond at all well to teachers who tried to teach with indirect methods such as those advocated by Flanders (1970), apparently because they had not yet mastered the basic tool skills which appear to be assumed by these methods. In contrast, the high SES students, who usually either had mastered or were in the process of mastering these skills to the point of overlearning, had reached a stage where they were beginning to profit from indirect teaching methods. Thus, optimal teaching in the low SES schools was heavily teacher centered and structured, while optimal teaching in the high SES schools was less teacher structured and more open to student input and student choice in assignments and activities. Similarly, optimal classroom management in low SES schools was tighter and more constraining, apparently because the children had not yet developed the abilities to move around freely and make choices independently without losing focus or becoming disruptive. In contrast, teachers working with high SES students were able to be much freer and more autonomy-granting, apparently because the students were able to exercise such freedom responsibly and productively.

Other research (reviewed in Brophy and Good, 1974) also has revealed interactions between student characteristics and teacher behaviors which affect student outcomes. These include the following:

Eager, extroverted students not only desire frequent participation in classroom discussion, but appear to profit from it; however, reticent or anxious students who hesitate to become involved in classroom discussions tend to do just as well and sometimes better than when their participation

is increased through deliberate intervention.

Students who desire structure do best in a highly structured class, while students who value independence and autonomy do best in classes taught by teachers who value or at least tolerate these traits.

Students with low self esteem and history of failure appear to require much encouragement and to be particularly vulnerable to criticism. In contrast, students with very high self esteem and a history of success usually do not find praise particularly rewarding or motivating. However, they do respond positively to challenges and, under some circumstances, to criticism (particularly when they have not been putting forth their best effort).

The materials and methods typically used in schools for teaching introductory reading appear to be well suited for most girls. However, boys tend to do better when these approaches are supplemented with programmed materials, computer assisted instruction, or other approaches that enable the student to work independently and/or that involve interesting gimmicks.

There are great individual differences in orientation towards cooperation versus competition (as well as cultural differences: school children in the United States tend to be much more competitive and less cooperative than school children in Mexico). Thus, it seems probable that attempts to motivate students through competition for individual rewards would be more successful with students who value competition, while attempts to motivate through fostering group cooperation would be more successful with students who valued cooperation.

Applied behavior modification studies have shown that students differ in their preferences for rewards. Some types of rewards are positively motivating to some students but not others, and even the same students will change in relative preference for different rewards over time. Thus, studies of motivational methods need to take into account not only teacher behavior but also the question of whether or not the behavior involved actually functioned as a reward for the student at whom it was directed.

Additional considerations concerning the interactions between individual student characteristics and optimal teacher behavior can be found in Brophy and Good (1974) and Cronbach (1975). By now, the major point of this paper should be obvious: students in the same classroom, no matter how homogeneous, show great individual differences in their personal characteristics and in the kinds of interactions that they have with the teacher. Consequently, research which is designed to better understand classroom processes and/or to link up classroom processes with student outcomes must begin to take into account these student individual differences and use the student as the unit of statistical analysis if significant improvements over the existing knowledge base are to be achieved.

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